DOCUMENT RESUME

ED 096 488 CE 002 100

TITLE	Precision Machining and Technology; Machine Shop Work--Advanced: 9557.04.
INSTITUTION	Dade County Public Schools, Miami, Fla.
PUB DATE	Dec 72
NOTE	25p.; An Authorized Course of Instruction for the Quinmester Program
EDRS PRICE	MF-$0.75 HC-$1.85 PLUS POSTAGE
DESCRIPTORS	Behavioral Objectives; *Curriculum Guides; Hydraulics; *Industrial Education; *Machine Tools; Numerical Control; Secondary Grades; *Shop Curriculum; Skill Development; Technical Education; Welding
IDENTIFIERS	*Quinmester Program

ABSTRACT

The course outline has been prepared as a guide to assist the instructor in systematically planning and presenting a variety of meaningful lessons to facilitate the necessary training for the machine shop student. The material is designed to enable the student to learn the manipulative skills and related knowledge necessary to understand the jig borer or bridgeport mill and welding equipment and their operations in a safe and productive manner; also to understand hydraulics and numerical control, and to become aware of employment opportunities. Prior to entry into this course, the student must display a mastery of the skills indicated in Metals and Alloys. This is the fourth Quinmester course of the second year, consisting of six blocks of instruction subdivided into several units each. This course is 135 hours in length. A bibliography and three posttests are appended to the outline. Specific objectives are provided for each unit. (Author/AJ)

ED 096488

52-2-2

CE

BEST COPY AVAILABLE

AUTHORIZED COURSE OF INSTRUCTION FOR THE QUINMESTER PROGRAM

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

V-2

Course Outline
MACHINE SHOP WORK - ADVANCED - 9557
(Precision Machining and Technology)
Department 48 - Quin 9557.04

CE002 100

DADE COUNTY PUBLIC SCHOOLS
DIVISION OF INSTRUCTION • 1973

D A D E C O U N T Y P U B L I C S C H O O L S

1 4 5 0 N O R T H E A S T S E C O N D A V E N U E

M I A M I, F L O R I D A 33132

Course Outline

MACHINE SHOP WORK - ADVANCED - 9557
(Precision Machining and Technology)

Department 48 - Quin 9557.04

county office of

VOCATIONAL AND ADULT EDUCATION

THE SCHOOL BOARD OF DADE COUNTY

Mr. G. Holmes Braddock, Chairman
Mr. William H. Turner, Vice-Chairman
Mrs. Ethel Beckham
Mrs. Crutcher Harrison
Mrs. Phyllis Miller
Mr. Robert Renick
Dr. Ben Sheppard

Dr. E. L. Whigham, Superintendent of Schools
Dade County Public Schools
Miami, Florida 33132

December, 1972

Published by the School Board of Dade County

Course Description

9557	48	9557.04	Precision Machining and Technology
State Category Number	County Dept. Number	County Course Number	Course Title

This quinmester prepares the student in further technology related to machine shop including hydraulics, numerical control and welding. The student will operate a Jig Borer or a Bridgeport mill in a precision manner with an assigned project. He will lay out the project, make a chart using coordinates, and follow the chart while performing the precision boring. Safety, theory, and industrial processes toward tool and die work are emphasized during the project work. This is the fourth quinmester course to be taken in the year of the vocational machine shop course.

Indicators of Success: Prior to entry into this course, the vocational student must display a mastery of the skills indicated in Metals and Alloys (9557.03).

Clock Hours: 135

PREFACE

The following quinmester course outline has been prepared as a guide to assist the instructor in systematically planning and in presenting a variety of meaningful lessons programmed to facilitate the necessary training for the machine shop student.

The material contained in this outline is designed to enable the student to learn the manipulative skills and related knowledge necessary to understand the jig borer or bridgeport mill and welding equipment and their operations in a safe and productive manner; also to understand hydraulics, numerical control and all employment opportunities.

Prior to entry into this course, the student must display a mastery of the skills indicated in Metals and Alloys (9557.03). This is the fourth quinmester course of the second year, consisting of six blocks of instruction which are subdivided into several units each. This course is 135 hours in length.

The classroom instruction includes lectures, demonstrations, group discussion, study periods, and use of various audiovisual aids.

This outline was developed through the cooperative efforts of the instructional and supervisory personnel, the advisory committee, and the Vocational Curriculum Materials Service, and has been approved by the Dade County Vocational Curriculum Committee.

TABLE OF CONTENTS
with Suggested Hourly Breakdown

	Page
PREFACE	i
GOALS	iii
SPECIFIC BLOCK OBJECTIVES	iv
BIBLIOGRAPHY	6
BLOCK	
I. HYDRAULICS (35 Hours)	
Power Transmission	1
Principles	1
Elements	1
II. PRECISION HOLE LOCATION, MACHINING, AND BORING (40 Hours)	
Precision Machine Tools	1
Coordinates	2
Order of Operation	2
Checking	2
III. ELECTRIC ARC AND OXYACETYLENE WELDING (26 Hours)	
Safety Precautions	2
Nomenclature	2
Electric Arc Welder Operations	3
Oxyacetylene Operations - Welding	3
IV. NUMERICAL CONTROL (24 Hours)	
Introduction	3
Tape-Controlling Medium	3
Point-to-Point Programming	3
Contour Programming	3
Advantages	4
Justifying Equipment	4
Organizing	4
Operation	4
Future Trends	4
V. EMPLOYMENT OPPORTUNITIES (10 Hours)	
Direct Occupations	4
Related Occupations	4
VI. QUINMESTER POST-TEST	
APPENDIX: QUINMESTER POST-TEST SAMPLES	10

GOALS

The student must be able to demonstrate:

1. Familiarity with shop equipment, materials, and regulations regarding school, shop, and safety; and an awareness of the employment opportunities in the machine trades.

2. The knowledge of the principles of hydraulic-power transmission, numerical control, and employment opportunities.

3. A basic knowledge of the jig borer and the bridgeport mill nomenclature, safety regulations, feeds, boring attachment, holding devices and to be proficient in the methods of precision boring.

4. A basic knowledge of the safety requirements, terms used, and the techniques of electric arc and oxyacetylene welding and cutting, and demonstrate a minimum, measurable proficiency in the area.

SPECIFIC BLOCK OBJECTIVES

BLOCK I - HYDRAULICS

The student must be able to:

1. Explain the transmission of power by hydraulics and its uses relative to the power machine tools.
2. List the different elements of hydraulics and explain their functions while in operation.

BLOCK II - PRECISION HOLE LOCATION, MACHINING, AND BORING

The student must be able to:

1. List the various jig borer and bridgeport parts, holding devices, and demonstrate the ability to operate them in a safe proper manner.
2. Exhibit the ability to make coordinate charts from blueprints and sketches by using arithmetic and trigonometry calculations for the precision hole locations.
3. Demonstrate the ability to set up by finding the proper table location and perform by boring a series of holes while using the coordinate chart for settings in a sequential manner.
4. Demonstrate the ability to inspect the finished holes by using precision measuring tools to insure accurate hole location.

BLOCK III - ELECTRIC ARC AND OXYACETYLENE WELDING

The student must be able to:

1. Demonstrate the ability to set up and perform various welding operations, and operate the arc and gas welding equipment in a safe, proper manner.
2. List the welding processes, welding equipment, and types of welds.

BLOCK IV - NUMERICAL CONTROL

The student must be able to:

1. Explain point-to-point programming, contour programming, and the part that tape controlling medium plays in the operation and function of numerical control.
2. List the advantages, justification of equipment, organization, operation, and future trends of numerical control in the machining trades.

BLOCK V - EMPLOYMENT OPPORTUNITIES

The student must be able to:

1. List the employment opportunities that are available for the students that complete the machine shop advanced course.

2. Define the eventual openings available in the related opportunities such as technicians, designers, teachers, and managers.

BLOCK VI - QUINMESTER POST-TEST

The student must me able to:

1. Satisfactorily complete the quinmester post-test.

Course Outline

MACHINE SHOP WORK - ADVANCED - 9557
(Precision Machining and Technology)

Department 48 - Quin 9557.04

I. HYDRAULICS

A. Power Transmission

B. Principles
1. Physical properties
2. Methods of control
a. Constant volume system
b. Variable volume system

C. Elements
1. Pumps
a. Gear
b. Vane
c. Plunger
d. Variable displacement
2. Valves
a. Piston type
b. Control
c. Resistance (foot)
3. Driven units
a. Piston
b. Cylinder
4. Cross feed mechanism
5. Rapid traverse and feed circuit
6. Automatic control
7. Oil requirements
a. Chemical stability
b. Demulsibility
c. Film strength
d. Viscosity

II. PRECISION HOLE LOCATION, MACHINING, AND BORING

A. Precision Machine Tools
1. Bridgeport mill
2. Jig borer
a. Parts
b. Spindle shank insertion
c. Work set up
(1) Settings
(2) Position
d. Precision boring head

B. Coordinates
   1. Rectangular
   2. Polar
   3. Charts

C. Order of Operation
   1. Coordinate chart
   2. Spot drilling
   3. Rough drilling and rough boring
   4. Original setting check
   5. Finish boring

D. Checking
   1. Precision measuring tools
   2. Drawings
   3. Coordinate chart
   4. Mathematical calculation

III. ELECTRIC ARC AND OXYACETYLENE WELDING

A. Safety Precautions
   1. Personal
      a. Eye, face, and hand protection
      b. Proper clothing
      c. Proper ventilation
      d. Fire extinguisher
      e. Welding curtains
   2. Work hazards
      a. Materials
      b. Holding devices
      c. Floor area
      d. Hot sparks and flame

B. Nomenclature
   1. Welding processes
      a. Electric arc
         (1) Welding
         (2) Cutting
      b. Oxyacetylene
         (1) Welding
         (2) Cutting
         (3) Brazing
   2. Arc welding equipment
      a. Alternating current machines - cables
         (1) Ground
         (2) Electrode
      b. Face shield
      c. Wire brush
      d. Chipping hammer
      e. Welding table and curtains
      f. Vise and clamps
      g. Electrodes

III. ELECTRIC ARC AND OXYACETYLENE WELDING (Contd.)

3. Oxyacetylene welding equipment
   a. Gas cylinders
      (1) Oxygen
      (2) Acetylene
   b. Regulators and gauges
   c. Color coded hoses
   d. Torch assembly and tips
      (1) Standard torch
      (2) Cutting torch
   e. Spark lighter
   f. Welding rods
   g. Flux
4. Types of welding joints
   a. Butt
   b. Tee
   c. Lap
   d. Edge
   e. Corner

C. Electric Arc Welder Operations
1. Welding
   a. Welder preparation
      (1) Cables
      (2) Electrodes
      (3) Amperage
   b. Workpiece preparation
      (1) Grounding
      (2) Clamping
2. Cutting

D. Oxyacetylene Operations - Welding
1. Torch and torch tips
2. Gas cylinders
3. Regulators
4. Spark lighters
5. Rods

IV. NUMERICAL CONTROL

A. Introduction

B. Tape-Controlling Medium
1. Coding
2. Format
3. Functions

C. Point-to-Point Programming

D. Contour Programming
1. Straight - line increments
2. Part-manually

E. Advantages
   1. Faster Production
   2. Savings
      a. Floor space
      b. Material
      c. Tooling
      d. Inspection time
      e. Flow time
      f. Inventory
      g. Scrap
   3. Accuracy
   4. Repeatability

F. Justifying Equipment
   1. Quantity of parts
   2. Complex work
   3. Lead time
   4. Design changes
   5. Tooling cost
   6. Inspection cost
   7. Floor space

G. Organizing

H. Operation
   1. Electronic control system
   2. The machine tool
   3. The drive unit or units
   4. The feed back
   5. Electrically operated controls
      a. Starters
      b. Relays
   6. Manual controls
      a. Buttons
      b. Dials
      c. Switches

I. Future Trends

V. EMPLOYMENT OPPORTUNITIES

A. Direct Occupations
   1. Apprenticeship
   2. All around machinist
   3. Machine tool operators
   4. Tool and die makers
   5. Instrument makers
   6. Setup men
   7. Layout men
   8. Inspectors

B. Related Occupations
   1. Technicians
   2. Managers

V. EMPLOYMENT OPPORTUNITIES (Contd.)

3. Teachers
4. Designers

VI. QUINMESTER POST-TEST

BIBLIOGRAPHY
(Precision Machining and Technology)

Basic References:

1. Althouse, Andrew D., and Others. Modern Welding. Chicago: Goodheart-Willcox Co., Inc., 1967. Pp. 712.

2. Giachino, J. W., and Others. Welding Technology. Chicago: American Technical Society, 1968. Pp. 480.

3. Johnson, Harold V. General-Industrial Machine Shop. Peoria: Illinois: Charles A. Bennett Co., Inc., 1963. Pp. 182

4. Ludwig, Oswald A. Metalwork Technology and Practice. Bloomington, Illinois: McKnight and McKnight, 1967. Pp. 399.

5. McCarthy, Willard J., and Smith, Robert E. Machine Tool Technology. Bloomington, Illinois: McKnight and McKnight, 1968. Pp. 672.

6. Oberg, Erik, and Jones, F. D. Machinery's Handbook. 18th ed. New York: The Industrial Press, 1968. Pp. 2293.

7. Porter, Harold W., and Others. Machine Shop Operations and Setups. Chicago: American Technical Society, 1967. Pp. 517.

Supplementary References:

8. Axelrod, Aaron. Machine Shop Mathematics. 2nd ed. New York: McGraw-Hill Book Company, Inc., 1951. Pp. 359.

9. Burghardt, Henry D., and Others. Machine Tool Operation. Part I. 5th ed. New York: McGraw-Hill Book Company, Inc., 1959. Pp. 588.

10. _____. Machine Tool Operation. Part II. 4th ed. New York; McGraw-Hill Book Company, Inc., 1960. Pp. 681.

11. Colving, Fred H., and Stanley, Frank A. American Machinist's Handbook. New York: McGraw-Hill Book Company, Inc., n.d. n.p.

12. Felker, C. A. Machine Shop Technology. Milwaukee: The Bruce Publishing Co., 1962. Pp. 491.

13. Heat Treatment of Metals. Albany, New York: Delmar Publishers, Inc., 1970. Pp. 58.

14. Henry Ford Trade School. Shop Theory. New York: McGraw-Hill Book Company, Inc., 1942. Pp. 267.

15. Jenson, C. H., and Mason, F. H. S. Drafting Fundamentals. 2nd ed. Toronto: McGraw-Hill Company of Canada Limited, 1967. Pp. 242.

16. Johnson, Carl G., and Weeks, William R. Metallurgy. 4th ed. Chicago: American Technical Society, 1956. Pp. 454.

17. Olivo, C. Thomas, and Payne, Albert V. Basic Blueprint Reading and Sketching. Albany, New York: Delmar Publishers, Inc., 1952. Pp. 145.

Manufacturer's Booklet:

18. Illinois Tool Works. Trigonometry Tables and Involute Functions. Chicago, 1963.

Periodicals:

19. Industrial Arts and Vocational Education. Milwaukee: The Bruce Publishing Co.

20. School Shop. Ann Arbor, Michigan: School Shop.

Teacher Aids:

21. Job Sheets, 100 and 200 Series. Miami, Florida: Division of Vocational and Adult Education, Dade County Public Schools.

22. Ohio Trade and Industrial Education Service. Job Sheets. Columbus, Ohio: Division of Vocational Education, State Department of Education, 1962.

23. Unit of Instruction Plans. Miami, Florida: Division of Vocational and Adult Education, Dade County Public Schools.

Films:

1. Anyone at All. (Safety). 16 mm. 22 min. B/W. Sound. n.d. Encyclopedia Britannica Films, Inc.

2. Cutting Threads with Taps and Dies. 16 mm. 19 min. B/W. Sound. United World Films, Inc.

3. Fundamentals of Filing. 16 mm. 12 min. B/W. Sound. United World Films, Inc.

4. Grinding Cutter Bits. 16 mm. 20 min. Color. Sound. South Bend Lathe Works.

5. Grinding a Parallel Bar. Part I. 16 mm. 14 min. B/W. United World Films, Inc.

6. Hacksaws. 16 mm. 18 min. B/W. Sound. United World Films, Inc.

7. Hammers. 16 mm. 11 min. B/W. Sound. United World Films, Inc.

8. Hand Soldering. 16 mm. 17 min. B/W. Sound. United World Films, Inc.

9. Hardness Testing: Rockwell. 16 mm. 18 min. B/W. Sound. United World Films, Inc.

10. Inspection of Threads. 16 mm. 22 min. B/W. Sound. United World Films, Inc.

11. Metal Working Lathe. 16 mm. 20 min. Color. Sound. South Bend Lathe works.

12. Micrometer. 16 mm. 15 min. B/W. Sound. United World Films, Inc.

13. Milling Machine. 16 mm. 8 min. B/W. Sound. United World Films, Inc.

14. Plain Indexing and Cutting a Spur Gear. 16 mm. 26 min. B/W. Sound. United World Films, Inc.

15. Plain Turning. 16 mm. 20 min. Color. Sound. South Bend Lathe Works.

16. Pliers and Screwdrivers. 16 mm. 18 min. B/W. Sound. United World Films, Inc.

17. Precisely So (History of Measurements). 16 mm. 20 min. B/W. Sound. General Motors, Inc.

18. Principles of Gearing: An Introduction. 16 mm. 18 min. B/W. Sound. United World Films, Inc.

19. Principles of Lubrication. 16 mm. 16 min. B/W. Sound. United World Films, Inc.

20. Punches, Drifts, and Bars. 16 mm. 14 min. B/W. Sound. United World Films, Inc.

21. Shop Procedures. 16 mm. 17 min. B/W. Sound. McGraw-Hill Book Company, Inc.

22. Steel Rule. 16 mm. 14 min. B/W. Sound. United World Films, Inc.

23. Steel Town. 16 mm. 17 min. B/W. Sound. United World Films, Inc.

24. Verniers. 16 mm. 19 min. B/W. Sound. United World Films, Inc.

25. Wrenches. 16 mm. 20 min. B/W. Sound. United World Films, Inc.

A P P E N D I X

Quinmester Post-Test Samples

Quinmester Post-Test

Name _____ Date _____ Score ____

I. Matching Test Items - The words and phrases in the left-hand column are significant in connection with an expression in the right-hand column. Match them properly by placing the figure preceding the item in the left-hand column in the brackets at the right of the matching item.

1.	Excessive spatter and noise from welding arc.	a. Used to construct a weldment so that all measurements can be checked	( )
2.	There is neither penatration nor an even deposit.	b. Permits the welder to get a better view of the crater	( )
3.	The build up will be excessive and beads will become burned and porous.	c. Current set too high or arc too long	( )
4.	Arc welding.	d. Short arc	( )
5.	Where metal has a deposite over a wider area than the diameter of the electrode.	e. Important for quality of final weld	( )
6.	Turn on the acetylene first.	f. When the speed of travel is too fast	( )
7.	Chipping out slag and wire burshing.	g. Striking or tapping method	( )
8.	Hold the top of the electrode 5 to 10 degrees at an angle.	h. If the speed of travel is too slow	( )
9.	Very little spatter.	i. Oxyacetylene welding	( )
10.	Tack welding.	j. Weaving is necessary	( )

Quinmester Post-Test

Name _____ Date _____ Score ____

II. Multiple Choice Test Items - Each statement needs a word, a figure, or a phrase to make it correct. Only one of the choices listed is correct. Place the letter of the choice you make in the space provided at the left edge of the sheet.

____ 1. Hydraulic-power transmission has an advantage of:

a. A faster motion when needed
b. Cheaper cost
c. An even, positive motion at all loads
d. No valves needed

____ 2. Hydraulics is a science that deals with the action of:

a. Liquids in motion
b. Grinding lubricants
c. Lubricating movable parts
d. Different grades of oil

____ 3. All liquids are relatively:

a. Compressible
b. Incompressible
c. The same weight
d. Decompressible

____ 4. A constant speed pump which has a variable rate of discharge is called a:

a. Variable pump
b. Vane pump
c. Gear pump
d. Plunger pump

____ 5. What is the name of a constant speed pump which has a constant discharge of volume of oil at constant pressures?

a. Vane
b. Constant
c. Plunger
d. Valve

____ 6. What pump is used in the variable-volume system?

a. Vane
b. Plunger
c. Gear
d. Variable

___ 7. Which of the following pumps is used in the constant-volume system?

a. Plunger
b. Gear
c. Constant
d. Intake

___ 8. The purpose of the valve in the hydraulic system pump is to:

a. Make the pump run faster
b. Start and stop the pump
c. Control the flow of oil
d. Control the speed of the pump

___ 9. The flow of oil in the hydraulic system is through passages called:

a. Inlets
b. Intakes
c. Outlets
d. Ports

___ 10. Most valves in the hydraulically operated machines are of the plunger or:

a. Vain type
b. Piston type
c. Control type
d. Resistance type

___ 11. Chemical stability, demulsibility, film strength, and viscosity are terms in the hydraulic system associated with the:

a. Cylinder
b. Power
c. Tank
d. Oil

___ 12. The variable-volume hydraulic system is used in the:

a. Milling machine
b. Drill press
c. Sharper
d. Surface grinder

___ 13. The constant-volume hydraulic system is associated with the:

a. Milling machine
b. Bridgeport mill
c. Shaper
d. Lathe

___ 14. Numerical control was first successfully demonstrated at the Massachusetts institute of technology in:

a. 1950
b. 1948
c. 1952
d. 1954

___ 15. Another type of numerical control other than contour continuous path is:

a. Circular
b. Zig-zag
c. Point-to-point
d. Straight and curve

___ 16. Numerical control is a system in which actions are controlled by the direct insertion of:

a. Automatic skills
b. Numerical data at some point
c. Increase manual operations
d. Total automation

___ 17. What is the most common controlling medium for numerical control?

a. Voice command
b. Computer cards
c. Movie film
d. Punched tape

___ 18. Contour programming is accomplished by:

a. Curving segments
b. Circular increments
c. Following a circular template
d. Short straight-line increments

___ 19. One of the advantages of numerical control must be the:

a. Accuracy
b. Savings of money even with more tool cost
c. Slower production but repeatability
d. Necessity to hire more employees

___ 20. The trend of the future for numerical controlled machinery sales will be:

a. Increasing
b. About the same
c. Decreasing
d. More manual controlled type

___ 21. A smaller machine shop which makes limited numbers of machine parts for manufacturers is called a:

a. Production shop
b. Job shop
c. Maintenance shop
d. Parts shop

____ 22. The all around machinist can progress by becoming a:

a. Machine operator
b. Layout man
c. Tool and die maker
d. Machine tool operator

____ 23. What would be an employment opportunity in a related occupation after completion of the machine shop courses?

a. Designer
b. Apprentice
c. All around machinist
d. Machine tool operator

____ 24. One of the direct occupational employment opportunities is:

a. Teaching
b. Estimating
c. Managing
d. Apprenticing

Quinmester Post-Test

Name _____ Date _____ Score ____

III. Essay Questions - Read each question carefully before attempting to answer it. Write or sketch the answers in the space provided. Be accurate and neat in your work. Each question counts 8 points.

1. Make a simple drawing of an aluminum plate with six holes which will be bored with precision. The holes are one-half inch in diameter. Number each hole and write your own dimensional distance between the holes.

2. From your above drawing make a coordinate chart, using rectangular coordinates with the down coordinate being four inches and the across coordinate being five inches.

3. Draw a simple piston-type reverse valve in both positions with arrows denoting the direction of the travel of the liquid.

4. Make a sketch showing how liguids can multiply force.

Key for Quinmester Post-Test

I. Matching Test Items

a. 10
b. 8
c. 1
d. 9
e. 7
f. 2
g. 4
h. 3
i. 6
j. 5

II. Multiple Choice Test Items

1. c
2. a
3. b
4. d
5. a
6. b
7. b
8. c
9. d
10. b
11. d
12. a
13. c
14. c
15. c
16. b
17. d
18. d
19. a
20. a
21. b
22. c
23. a
24. d

III. Essay Questions

1. Answer determined by teacher.

2. " "

3. " "

4. " "